Fieldbus Components, Communication System and Process for the Transmission of Data Over a High Speed Transmission Medium

Cross-References to Related Applications

Not applicable.

Statement Regarding Federally Sponsored Research or Development

Not applicable.

Background of the Invention

Field of the Invention

The invention relates to a fieldbus component, a communication system including several fieldbus components, and also a process of the transmission of data over a high speed transmission medium.

Discussion of Relevant Art

So-called fieldbus systems are used today in automation technology as a technique for connecting between the equipments taking part in the production process. These fieldbus systems usually work at transmission rates < 10 Mbit/s. There is a need for higher bandwidth of the fieldbus systems because of the increasing penetration of the fieldbus systems into all regions of automation technology, on the one hand, and the increasing capacity of the control systems on the other hand.

In the field of information technology, and particular in the local area network region, there already exist networks, known as Ethernet, with a bandwidth of 10 Mbit/s. This

network technology is constantly being developed, corresponding to the constantly increasing need for bandwidth. Transmission speeds of 100 Mbit/s at a distance of up to 100 m are made possible by the use of a copper-based transmission medium. This network is also known as Fast Ethernet.

Summary of the Invention

The present invention has as its object to provide a fieldbus component, a communication system, and a process with which it is possible to use fieldbus components in high speed data transmission.

The invention attains the solution of this problem with a fieldbus component including a data link layer and a physical layer. The physical layer is constituted for a high speed data transmission. An interface connecting the data link layer and the physical layer, and a layer for matching the data link layer, which operates with a fieldbus protocol, to the physical layer, are provided.

According to the invention, the fieldbus component has a data link layer (this corresponds to layer 2 of the OSI reference model) and a physical layer (this corresponds to the first layer of the OSI reference model). In order to make the fieldbus component capable of a high speed data transmission, the physical layer is constituted for high speed data transmission. Furthermore, there are provided an interface which connects the data link layer and the physical layer, and also a layer for matching the data link layer, which operates with a fieldbus protocol, to the physical layer.

The Fast Ethernet offers a suitable transmission technique, with a transmission rate

of 100 Mbit/s. In this case, the physical layer is constructed according to the IEEE 802 standard of the Fast Ethernet. An advantage of this is that the already existing, standard physical layer and its acceptance in the field of office communications has given rise to numerous semiconductor implementations. These components which implement the physical layer are already available on the market at a favorable price.

As the interface which connects the physical layer and the data link layer, the likewise standardized Medium Independent Interface (MII) according to the IEEE 802 standard can be used.

For the fieldbus components, there are concerned, for example, components which are suitable for the EN50258 standard, which was developed for the Interbus fieldbus system, with the exception of the layer 1 described there.

In a known manner, the data link layer includes a medium access control layer, a basic connection layer, a peripheral data connection layer, and a network management layer.

According to a further aspect of the invention, a communication system, in particular an automation system, has a high speed data transmission medium to which several fieldbus components can be coupled.

The high speed data transmission medium is constructed for fieldbus systems as a linear structure, from which stub leads can branch. The fieldbus components are actively coupled to the transmission medium.

It should be mentioned at this point that the fieldbus components can all contain partial layers. It is furthermore conceivable to implement the data link layer and if

necessary the matching layer in the fieldbus component, and the physical layer together with the interface in a separate module associated with the high speed data transmission medium.

A further aspect of the invention is directed toward a process for the transmission of data over a high speed data transmission medium to which several fieldbus components are connected.

Brief Description of the Drawings

The invention will be described in more detail hereinbelow in connection with the accompanying drawings, in which:

Fig. 1 shows a diagram of a fieldbus system with two fieldbus components connected to a high speed data transmission medium.

Fig. 2 shows a detailed sketch of a basic circuit of the fieldbus component according to the invention.

Detailed Description of Preferred Embodiments

Fig. 1 shows two fieldbus components 10 and 20, which are connected in series to a high speed data transmission medium 30 corresponding to the Fast Ethernet network technology. The connection of the fieldbus components 10, 20 to the transmission medium 30 takes place, for example, by means of a RJ-45 plug connector 40. The fieldbus components 10 and 20 have respective separate, identically constructed, channels of a physical layer 60 for an input lead 32 and for an output lead 34 of the transmission medium

30. It may be pointed out here that the leads 32 and 34 can be made bidirectional.

The physical layer 60 shown in Fig. 2 is constructed according to the IEEE 802.3u standard, and hence is known. A detailed description of the individual functional units is therefore unnecessary. For completeness, only the important functional units are named here: the medium-dependent interface 61 (Medium Dependent Interface, MDI), which produces the direct connection to the transmission medium 30. Furthermore the physical layer includes a physical, medium-dependent interface (Physical Medium Dependent, PDI) 62, a physical connection layer (PMA, Physical Medium Attachment) 63, and also a physical coding sublayer 64, which is followed by a medium-independent interface MII (Medium Independent Interface) 65. The medium-independent interface 65 produces the connection to the data link layer 70. The medium-independent interface 65 can alternatively be constituted as a Reduced Medium Independent Interface, R-MII) or as the symbol interface.

The data coming from the user of the data link layer 70 are combined into a frame to be transmitted, which typically consists of a preamble, a start limiter field, a frame type field, a frame length field, a header check field, the data field proper, a data check field, and an end limiter field. Since however, as regards the fieldbus components 10 and 20, no Fast Ethernet compatible assembly is concerned, a matching layer 71 is required which matches the data frame prepared by the data link layer 70 of the fieldbus components 10, 20 to the physical layer 60 of the Fast Ethernet. These field data are furthermore passed on to the medium-independent interface 65 and the underlying physical layers 64-61, and are transmitted by means of the transmission medium 30 of the subsequent fieldbus

component 20. It can however be left undecided for the functional capability of the fieldbus components 10 and 20, whether the matching layer 71 is to be associated with the data link layer 70 or with the physical layer 60.

As will be apparent from Fig. 2, the data link layer 70 includes, for example, a Medium Access Control (MAC) layer 72, a Basic Link Layer (BLL) 73, a peripheral data connection layer (PDP, Peripheral Data Link) 74, and also a network management layer 75.

Fig. 1 will be considered again. Basically the Fast Ethernet envisions a star-shaped or point-to-point connection. In the fieldbus systems, the fieldbus components 10 and 20 are to be connected in a known manner in line with optional branching stub leads and in the form of an active coupling. Thus the necessity exists for at least two interfaces per fieldbus component 10, 20. However, in the sense of the fail-safe security of the communication system and the absence of feedback during the removal/insertion of fieldbus components 10 and 20 while the communication system is operating, it can be appropriate to combine these two interfaces, as shown in Fig. 1, into one physical layer (plug connection).

It is possible by means of the invention, especially, to match fieldbus protocols which deviate from the Fast Ethernet standard such that the fieldbus component 10, 20 which use the fieldbus protocols can communicate over the physical layer 60 of the Fast Ethernet. It is thereby possible for the first time to realize high speed transmissions, as known from the Fast Ethernet, with fieldbus systems in the field of industrial automation.